Expected Level of Effort for Sampling and Analysis of Benthic Macroinvertebrate Tissue - Upper Columbia River Site

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1. Purpose

This level of effort (LOE) technical memorandum (TM) outlines the work Teck American Inc. (TAI) is expected to undertake to delineate and characterize the levels of the chemicals of interest (COIs) in tissues of mussels and crayfish sampled from the Upper Columbia River (UCR) Site. The LOE is the first step in a process that culminates in approval of a quality assurance project plan (QAPP) for collection and analysis of samples at the UCR Site. The data generated as a result of implementing the benthic invertebrate tissue QAPP must be of suitable quality for the assessment of risks to human and ecological receptors that may consume benthic invertebrates within the UCR Site.

For the purposes of this LOE TM, benthic macroinvertebrate will be represented by mussels and crayfish. Within the UCR, mussels and crayfish are an important food source for numerous fish (including white sturgeon), some aquatic-dependent wildlife species, and humans. Ecological and human receptors consuming mussels and crayfish could be exposed to, and be placed at risk by, contaminants of interest (COIs) that have accumulated in the tissues of these macroinvertebrates. At present, the lack of high quality tissue data representative of current UCR conditions is a significant data gap for both the human health and ecological risk assessment processes. EPA specifically expects the Baseline Ecological Risk Assessment (BERA) for the UCR site to consider mussel and crayfish tissue concentration data in aquatic-dependent wildlife exposures modeling. Mussel and crayfish tissue concentration data will also be used in the Human Health Risk Assessment (HHRA).

2. Required LOE

EPA's anticipated minimum level of effort for the sampling and analysis of mussels and crayfish is described below.

2.1 Sample Locations, Number, and Timing

Mussels and crayfish have been found in the tributaries, reservoir, and the main stem of the UCR and consumption survey data for the Colville Confederated Tribes (CCT) show that freshwater mussels and crayfish are consumed by local residents (Westat 2012). These organisms are also consumed by aquatic-dependent wildlife. The QAPP must specify, and provide a rationale for, the number of sampling sites and their locations within areas of the UCR affected by contamination and in background (or reference) areas.

Statistically-based sampling may be used to obtain coverage throughout the UCR, but sampling must also occur in areas of known sediment contamination, from areas known to be used by UCR residents (e.g., Westat 2012), and in areas where known target species are located (USFWS 2012; Exhibit 1; Attachment A). Sampling locations may include those referenced in the Tribal Consumption and

Resource Use Survey (Westat, 2012) (e.g, Rebecca Lake, Buffalo Lake, the mouth of the Sanpoil River), and the Swawilla Basin (western Lake Roosevelt). The total number of sampling locations must be sufficient to meet the data needs of the risk assessments.

If seasonal affects on species presence or activity is a consideration, the QAPP must specify when samples should be collected. For example, sampling prior to crayfish spawning (June-July) would result in more conservative tissue concentrations while post-spawn sampling would be less conservative due to maternal transfer of contaminants causing a reduction in female mussels and crayfish body burdens.

The QAPP should propose an approach for deriving site-specific background concentrations for COIs in representative benthic macroinvertebrates. Possible locations for background samples should consider tributaries not affected by mining sources and may include locations upstream of Trail. Reconnaissance may be necessary to confirm the presence and abundance of comparable species at potential reference locations. Also consider that background locations may need to differ for crayfish and mussels due to the more mobile nature of crayfish (i.e., relatively larger home range) that could travel between tributaries and exposed areas.

Exhibit 1. Target Mussels and Crayfish Occurrence in the UCR.

Species	Locations Mussels and Crayfish are Known to Occur
Crayfish	Plentiful from Spring Canyon to the Sanpoil River Orapaken and Alder Creeks (North of Hunters) North Columbia Campground (confluence with the UCR approximately 5 miles north of the Spokane R. confluence; east side) Castle Rock Creek (confluence with the UCR approximately 3 miles north of the Spokane R. confluence; east side)
Orconectes virilis (Northern/virile crayfish)	Upper Columbia River (dominant species)
Pacifastacus leniusculus (Signal crayfish; native; not abundant)	Keller Ferry, Not abundant/Not in main stem UCR; Kettle River and Spokane River
Mussels	Kettle River and tributaries Cayuse Cove – mussel bed downstream of Porcupine Bay
Anodonta clade 2 (Oregon/western floater)	
Anodonta Clade 1 (winged/California floater)	Hayes Island (highest densities of all mussels)
Anodonta beringiana (Yukon floater; *historic populations*)	
Margaritifera falcata (western pearlshell; historic; not found in recent USFWS surveys)	Little Jim Creek, North Gorge, China Bar, Deadman's Eddy , Kettle River
Gonidea angulata (Western ridged mussel)	
Invasive clams (e.g., *Corbicula fluminea*)	Keller Ferry

2.2 Sample Types, Number, and Size

The QAPP must specify and provide a rationale for the type (e.g., species, size), number, and size (i.e., mass) of samples to be collected at each sample location. Sampled individuals should be identified to genus or species. Mussel identification methods should be based on *Freshwater Mussels of the Pacific Northwest (*Nedeau *et al.* 2009) with a caution that shell morphology may not be reliable to determine species, but may be reliable for clades (particularly for *Anodonta* sp.).

The sample volume needed to support chemical analyses must be described. It may be difficult to collect sufficient tissue mass from an individual organism to meet analytical chemistry requirements; therefore, the volume required may need to be achieved by composite sampling at any given location. If composite sampling is anticipated (e.g., separate samples for different species, compositing among taxa, or compositing within taxa), the QAPP should specify a compositing scheme deemed optimal for estimating exposure point concentrations for use in both human and ecological risk assessments.

This discussion should consider the approach and rationale for collecting and comparing samples from exposed and reference locations that may consist of different species. For example, northern crayfish dominate the crayfish community in the UCR whereas the native signal crayfish have been rarely encountered in the UCR and are present in the Kettle River. The Kettle River may not be an appropriate background sampling location for crayfish as natives may have different uptake rates/tissue concentrations than non-natives. TAI will report the location and consult with EPA if signal crayfish are encountered in the reservoir or riverine segments of the UCR. Likewise, the western pearlshell mussel is found in the Kettle River but has not been found in recent years in the mainstem UCR. If found, these would be preferentially collected for consumption by UCR residents.TAI will report the location and consult with EPA if western pearlshell mussels are found in the reservoir or riverine segments of the UCR. Also note that invasive clams (e.g., *Corbicula sp.)* are not target species and should be sampled separately from mussels, if encountered. A plan for handling and processing any incidental capture of non-target species, consistent with collection permit requirements, should also be described in the QAPP.

The QAPP should discuss whether any specific ages, size classes, or stages of species are required or preferred. For example, soft-shelled crayfish could be sampled separately from hard-shelled crayfish. A description and rationale for handling and processing these samples should be described. Northern crayfish may be abundant enough to determine concentration differences between soft and hard-shelled samples. Any observed abnormalities will be documented (i.e., photo and description in notes).

Viscera-only samples are acceptable for mussels. Whole-body samples should be collected for crayfish (which can be consumed whole by both humans and wildlife). Additional samples of just the tail/claws and just the head/viscera should also be considered for human consumers to evaluate exposures for those who selectively consume these parts (Westat 2012). Individuals should not be depurated prior to analysis.

2.3 SOP for Sample Collection

The QAPP should include an appendix detailing the standard operating procedures (SOPs) for the collection and handling of benthic macroinvertebrate tissue samples, including quality assurance (QA) samples, up to the point they are shipped to the laboratory for analysis.

Many different styles of traps are available for collecting crayfish and method success can depend on the habitat (USFWS pers. comm.). Traps with escape guards should be used, and bait placed in cheesecloth or nylon bags that cannot be torn open by crayfish claws. Common baits used in traps

include canned cat food, hot dog pieces, and cut-up pieces of fish (which are reportedly quite successful). Fish oils can also be used on the bait bags. The USFWS deployed traps (and captured crayfish) in water-depths ranging from 2 to 60 feet (USFWS 2012), so variable sampling depths can be achieved and should be considered in the QAPP. Trapping areas should also be selected based on suitable crayfish habitat. The use and bias associated with various mussel sampling methods (e.g., Ponar dredges, brail bars, benthic dredges) are described by Strayer and Smith (2003).

2.4 Analyses

The Remedial Investigation/Feasibility Study (RI/FS) work plan (USEPA, 2008) defined the initial COIs for the RI/FS. The 2010 screening-level ecological risk assessment (SLERA) (TAI 2009) identified COIs that could be eliminated from further consideration within broad media categories, as well as chemicals of potential concern (COPCs) that required further evaluation. Based on the SLERA, a wide variety of chemicals may be of concern in the UCR. These include metals and metalloids, semi-volatile organic compounds including PAHs, pesticides, polychlorinated biphenyls (PCBs), polybrominated diphenylethers (PBDEs), and polychlorinated dibenzodioxins and dibenzofurans (TCDDs/ TCDFs). Due to the conservative nature of the assumptions used in the SLERA, it is possible that some COPCs that actually do not pose a risk were screened through to the baseline ecological risk assessment (BERA). However, analyses should be described in the benthic invertebrate tissue QAPP for all COPCs that may pose a risk to receptors that consume benthic invertebrates.

When selecting target analytes for benthic macroinvertebrate tissue analyses, the QAPP will discuss whether analytes can be prioritized based on the available sample mass. At a minimum, all samples will be analyzed for metals, speciated arsenic, inorganic and methyl mercury, percent lipids and percent moisture.

At the laboratory, samples will be processed and analyzed for the selected target analytes using EPA approved analytical methods and appropriate QA/QC procedures, including analyses of invertebrate tissue standard reference materials. Analytical methods, including sample extraction methods, and performance criteria (e.g., MDLs and MRLs) will be described in the QAPP. Tissue samples will also be analyzed for percent lipids and percent moisture. The QAPP should include (as appendices) SOPs that will be used by the selected laboratory for the preparation and extraction of biota tissue samples, as well as procedures for the calculation of percent lipids.

3.0 References

Nedeau, E.J., A.K. Smith, J. Stone, and S. Jepsen. 2009. Freshwater Mussels of the Pacific Northwest. Second Edition. http://www.xerces.org/wp-content/uploads/2009/06/pnw_mussel_guide_2nd_edition.pdf

Strayer, D.L. and D.R. Smith. 2003. A guide to sampling freshwater mussel populations. American Fisheries Society, Monograph 8. Bethesda, Maryland.

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U.S. Environmental Protection Agency (USEPA). 2008. Remedial Investigation/Feasibility Study Work Plan — Upper Columbia River Site. Prepared by CH2M HILL.

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Westat. 2012. Upper Columbia River Site Remedial Investigation and Feasibility Study Tribal Consumption and Resource Use Survey. Final Report. Prepared for the USEPA, Region 10. June 22, 2012.